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ABSTRACT

The purpose of this study was to determine whether existing instrumentation is capable of identifying learning style differences within and among college students. Focusing upon methodology, rather than processing, the Renzulli/Smith Learning Style Inventory (RSLI) was administered to 115 sophomores and juniors. The RSLSI was developed to assess the preferences of children for nine teaching methods: projects, simulations, drill and recitation, peer teaching, discussion, teaching games, independent study, programmed instruction, and lecture. It was previously validated with seventh- and eighth-grade students. The majority of the college students in this study showed high preferences for peer teaching, discussion, teaching games, programmed instruction, and lecture. Females tended to prefer teaching games and programmed instruction more than males. More average students preferred discussion than high-achieving students. More students from large schools preferred discussion than students from small schools. Areas for further research are outlined. (BW)

An Inventory Approach to Assessing the Learning Styles of College Students

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The recent practice in assessing learning styles in elementary and secondary gifted programs has expanded to the application of such assessment to all K-12 students. The present study is unique in that the authors have explored the potentiality of performing a similar assessment at the college level (more specifically, college sophomores and juniors) in an attempt to determine whether existing instrumentation is capable of identifying learning style differences within and among such students.

The vast array of Learning Style Inventories on the market forced the researchers to focus upon the use of a single inventory. Research abounds relative to such inventories as Cognitive Style Mapping (DeNike & Strother, 1975; Strother, 1980) the Dunn & Dunn Learning Style Inventory (Dunn & Dunn, 1977; Dunn, 1975; Price, 1980; Griggs, 1981) as well as Kolb's Learning Style Inventory (Kotar, 1983), and their use with college level students. As a result of our experiences with such instruments and a review of the literature resulting from applications the authors decided to select an inventory that focused upon methodology rather than processing. The Renzulli/Smith Learning Style Inventory (Renzulli & Smith, 1978) was perceived as meeting this need most adequately.

Methodology

One-hundred fifteen (115) sophomore/junior-level students enrolled in the Educational Psychology classes at South Dakota State University were given the Renzulli/Smith Learning Style Inventory (RSLSI) during Fall Semester, 1982. Due to student errors in answering, five (5) students were deleted resulting in a total N of 110 students. Independent variables included the student's; (a) sex, (b) age, (c) major, (d) GPA, (e) size of high school graduating class, and (f) position in family.

Instrumentation

The RSLSI was developed to assess the learning styles of children relative to nine (9) areas including; (a) Projects, (b) Simulations, (c) Drill and Recitation, (d) Peer Teaching, (e) Discussion, (f) Teaching Games, (g) Independent Study, (h) Programmed Instruction, and (i) Lecture. The instrument consists of 65 items which were developed to assess student preference in one (1) or more of these nine (9) areas. Content validity was determined by a group of 23 expert judges (Renzulli & Smith, 1978). Construct validity was based on answers secured from 700 seventh and eighth grade students and submitted to an oblique rotation analysis (Hoffman, 1970) by area. Using the Spearman-Brown formula reliability was established and showed a range of .66 to .77 across the nine (9) areas. In

the present study, internal consistency reliability coefficients ranged from .67 to .82 on the nine (9) subscales, with an overall reliability of .90. A summary of the instrument reliability analysis was presented in Table 1.

Results

Scoring instructions established by the instrument authors indicate that average item means (for each subscale) be used to identify two (2) categories as follows:

1. Less than 2.5 = Low Preference
2. Greater than 3.0 = High Preference

In the present study this procedure was modified to more precisely identify the "High Preference" categories by raising this criterion to a mean of >3.49, or 3.5 and higher.

In conjunction with overall results selected demographic (independent) variables were used to determine whether or not learning preference differences were evidenced. These independent variables included the following:

1. Sex of the respondent.
2. Self-reported Grade Point Average (GPA).
3. Size of High School Graduation Class (High School Size).

The results of these analysis were reported in Tables 2 through 11.

Table 1

SUMMARY OF INSTRUMENT
RELIABILITY ANALYSIS (RSLSI)

Subscale	Mean	Number Of Items	Average Item Mean	Internal Consistency Coefficient
Projects	28.53	9	3.20	.82
Simulations	18.67	6	3.12	.76
Drill and Recitations	24.91	8	3.14	.77
Peer Teaching	22.10	6	3.73	.78
Discussion	28.76	8	3.64	.79
Teaching Games	18.71	5	3.76	.75
Independent Study	25.80	9	2.88	.80
Programmed Instruction	25.96	7	3.72	.67
Lecture	26.60	7	3.81	.72
Overall	220.04	65	3.39	.90

Overall Response

Table 2 was used to report a breakdown of overall results by subscale. It should be noted that the middle or "Neutral" response percentages were also reported in the table.

As can be noted in Table 2, High Preference areas (subscales) included Peer Teaching (65.5%), Discussion (60.9%), Teaching Games (68.2%), Programmed Instruction (67.3%), and Lecture (72.7%).

Low Preference subscales (although less substantial than the High Preference percentages) were Simulation (21.8%) and Independent Study (24.5%).

Sex

The responses were also compared by sex of the respondent. These analyses were presented in Table 3. As can be noted, the population consisted of 70 females and 40 males. Although the High Preference subscale areas were generally maintained by both sexes, the percentage of responses was larger for the females in all five (5) cases with 71.4/55.0, 65.7/52.5, 80.0/47.5, 75.7/52.5 and 80.0/60.0 % respectively. The greatest by sex differences were noted in the subscale Teaching Games (80.0/47.5%) and Programmed Instruction (75.7/52.5%).

Table 2
SUMMARY OF PREFERENCE CATEGORIES
(OVERALL) BY SUBSCALE

Subscale	% Low Preference	% Neutral	% High Preference
Projects	11.8	60.0	28.2
Simulations	21.8	52.7	25.5
Drills and Recitation	19.1	56.4	24.5
Peer Teaching	1.8	32.7	65.5
Discussion	1.8	37.3	60.9
Teaching Games	5.1	26.4	68.2
Independent Study	24.5	61.8	13.6
Programmed Instruction	0.9	31.8	67.3
Lecture	0.9	26.4	72.7

Table 3
SUMMARY TABLE OF PREFERENCE CATEGORIES
BY SEX BY SUBSCALE
N=70 Females, N=40 Males

Subscale	Low Preference		Neutral		High Preference	
	% Female	% Male	% Female	% Male	% Female	% Male
Projects	7.1	20.0	60.0	60.0	32.9	20.0
Simulations	20.0	25.0	57.1	45.0	22.9	30.0
Drill and Recitation	18.6	20.0	57.1	55.0	24.3	25.0
Peer Teaching	2.9	0.0	25.7	45.0	71.4	55.0
Discussion	1.4	2.5	32.9	4.0	65.7	52.5
Teaching Games	5.7	5.0	14.3	47.5	80.0	47.5
Independent Study	21.4	30.0	62.9	60.0	15.7	10.0
Programmed Instruction	1.4	0.0	22.9	47.5	75.7	52.5
Lecture	1.4	0.0	18.6	40.0	80.0	60.0

GPA

The responses were also compared on the basis of self-reported Grade Point Average (GPA). Using the four-point GPA schedule employed at South Dakota State University the GPA responses were categorized as follows:

1. 4.00 - 3.50 (N = 18)
2. 3.49 - 3.00 (N = 26)
3. 2.99 - 2.50 (N = 45)
4. 2.49 and below (N = 21)

Overall responses by subscale were reported and summarized in Tables 4 through 7.

Table 8 was used to cross-tabulate the High Preference response percentages by GPA. Several interesting patterns emerged when reviewing this table.

When comparing High GPA Preferences with average and below GPA Preferences one can immediately note preference differences. Students with high GPA's (3.5 - 4.0) preferred Peer Te ching (66.7%), Teaching Games (72.2%), Programmed Instruction (77.8%) and Lecture (83.3%) while students with a low GPA (2.49 and below) did not prefer any category at a noticeable level (60% or higher).

It was also interesting to note that while 28.2% of the total subjects preferred Projects only 9.5% of the lower GPA students preferred this category.

Table 4
SUMMARY TABLE OF PREFERENCE CATEGORIES
BY SUBSCALE BY G.P.A.
(G.P.A. = 4.0 - 3.50, N = 18)

Subscale	Low	Neutral	High
Projects	16.7	61.1	22.2
Simulations	38 9	38.9	22.2
Drill and Recitations	5.6	55.6	38.9
Peer Teaching	5.6	27.8	66.7
Discussion	0.0	55.6	44.4
Teaching Games	0.0	27.8	72.2
Independent Study.	22.2	55.6	22.2
Programmed Instruction	0.0	22.2	77.8
Lecture	0.0	16.7	83.3

Table 5
SUMMARY TABLE OF PREFERENCE CATEGORIES
BY SEX BY SUBSCALE
G.P.A. = 3.49 - 3.00 (N = 26)

Subscale	Low	Neutral	High
Projects	3.8	69.2	26.9
Simulations	19.2	57.7	23.1
Drill and Recitation	23.1	50 0	26.9
Peer Teaching	3.8	34 6	61.5
Discussion	0.0	30.8	69.2
Teaching Games	3.8	26.9	69.2
Independent Study	11.5	65.4	23.1
Programmed Instruction	0.0	23.1	76.9
Lecture	0.0	7.7	92.3

Table 6
SUMMARY TABLE OF PREFERENCE
CATEGORIES
G.P.A. 2.99-2.50
(N=45)

Subscale	Low	Neutral	High
Projects	15.6	44.4	40.0
Simulations	17.8	51.1	31.1
Drill & Recitation	24.4	53.3	22.2
Peer Teaching	0.0	24.4	75.6
Discussion	4.4	22.2	73.3
Teaching Games	4.4	20.0	75.6
Independent Study	24.4	64.4	11.1
Programmed Inst.	2.2	26.7	71.1
Lecture	0.0	33.3	66.7

Table 7
SUMMARY TABLE OF PREFERENCE CATEGORIES
G.P.A. 2.49 & below
(N=21)

Subscale	Low	Neutral	High
Projects	9.5	81.0	9.5
Simulations	19.0	61.9	19.0
Drill & Recitation	14.3	71.4	14.3
Peer Teaching	0.0	52.4	47.6
Discussion	0.0	61.9	38.1
Teaching Games	14.3	38.1	47.6
Independent Study	42.9	57.1	0.0
Programmed Inst.	0.0	61.9	38.1
Lecture	4.8	42.9	52.4

Table 8
SUMMARY OF HIGH PREFERENCE
CATEGORIES BY G.P.A.

Subscale	N=18 4.00-3.50	N=26 3.49-3.00	N=45 2.99-2.50	N=21 2.49 & below	N=110 Overall
	%	%	%	%	%
Projects	22.2	26.9	40.0	9.5	28.2
Simulations	22.2	23.1	31.1	19.0	25.5
Drill & Recitation	38.9	26.9	22.2	14.3	24.5
Peer Teaching	66.7	61.5	75.6	47.6	65.5
Discussion	44.4	69.2	73.3	38.1	60.9
Teaching Games	72.2	69.2	75.6	47.6	68.2
Independent Study	22.2	23.1	11.1	0.0	13.6
Programmed Inst.	77.8	76.9	71.1	38.1	67.3
Lecture	83.3	92.3	66.7	52.4	72.7

While one would expect brighter students to prefer Independent Study as a means of learning (Stewart, 1981), only 22.2% of the high GPA subjects tested preferred this mode. None of the lower GPA students saw this as a preferred mode and only 11.1% of the average students (2.99 - 2.50) preferred this mode of learning.

The last interesting pattern is found in the Discussion category. While almost three-fourths (73.3%) of the students with "C" average GPA's (2.50 - 2.99) preferred this mode of learning, only 44.4% of the "A" students (3.5 - 4.0) students indicated this as a preference area.

Table 9 was used to present a summary of "Low Preference" categories by GPA.

Thirty-eight percent (38%) of the brighter students (3.5 - 4.0) indicated a non-preference for learning through the simulation mode, while the overall group had 21.8% indicating this as a non-preference mode.

Of the lower GPA students (2.49 and below) 42.9% indicated a lack of preference for the Independent Study category while only 24.5% of the overall group ranked this at a low level.

Table 9
SUMMARY OF LOW PREFERENCE
CATEGORIES BY G.P.A.

Subscale	N=18 4.00-3.50	N=26 3.49-3.00	N=45 2.99-2.50	N=21 2.49 & below	N=110 Overall
	%	%	%	%	%
Projects	16.7	3.8	15.6	9.5	11.8
Simulations	38.9	19.2	17.8	19.0	21.8
Drill & Recitations	5.6	23.1	24.4	14.3	19.1
Peer Teaching	5.6	3.8	0.0	0.0	1.8
Discussion	0.0	0.0	4.4	0.0	1.8
Teaching Games	0.0	3.8	4.4	14.3	5.1
Independent Study	22.2	11.5	24.4	42.9	24.5
Programmed Inst.	0.0	0.0	2.2	0.0	0.9
Lecture	0.0	0.0	0.0	4.8	0.9

Preferences by Size of Graduating Class

As can be noted in Table 10, Peer Teaching, Discussion, Teaching Games, Programmed Instruction and Lecture were indicated as preferences by at least 50% of the respondents in all but two groups. Only 43.2% of the small schools (less than 50) preferred discussion while 90% of the large schools respondents preferred this method of learning. Only 40% of the large schools subjects preferred Teaching Games.

Low Preference responses were reported in Table 11. There were no groups with a noticeable percentage of respondents reporting a low preference. However, all groups reported a low preference for Simulation (15.6% - 30.0%) and for Independent Study (10.0% - 35.7%).

Chi-Square Analyses

In the interest of determining whether response differences were statistically significant ($<.05$ probability), Chi-square analyses were performed. These results were reported below. It should be noted that these presentations were limited to statistical results. Actual contingency tables were not included in the interest of space reduction.

Sex

Females as a group reported a greater preference than males in all subscales with the exception of Simulation. The results were reported in Table 12. Significant differ-

Table 10

SUMMARY OF HIGH PREFERENCE CATEGORIES
BY SIZE OF GRADUATING CLASS

Subscale	N=44 Less Than 50	N=32 51-150	N=10 151-250	N=14 251-500	N=10 Over 500
Projects	18.2	46.9	40.0	14.3	20.0
Simulations	20.5	37.5	40.0	21.4	0.0
Drill & Recit.	18.2	21.9	20.0	57.1	20.0
Peer Teaching	61.4	71.9	50.0	85.7	50.0
Discussion	43.2	68.8	70.0	71.4	90.0
Teaching Games	72.7	68.8	70.0	71.4	40.0
Ind. Study	9.1	21.9	20.0	14.3	0.0
Prog. Inst.	50.0	78.1	80.0	85.7	70.0
Lecture	63.6	87.5	80.0	57.1	80.0

Table 11

SUMMARY OF LOW PREFERENCE CATEGORIES
BY SIZE OF GRADUATING CLASS

Subscale	N=44 <50	N=32 51-150	N=10 151-250	N=14 251-500	N=10 >500
Projects	15.9	12.5	20.0	0.0	0.0
Simulations	22.7	15.6	20.0	28.6	30.0
Drill and Recitations	25.0	12.5	30.0	7.1	20.0
Peer Teaching	2.3	0.0	10.0	0.0	0.0
Discussion	2.3	3.1	0.0	0.0	0.0
Teaching Games	6.8	3.1	0.0	0.0	20.0
Independent Study	27.3	21.9	10.0	35.7	20.0
Programmed Instruction	2.3	0.0	0.0	0.0	0.0
Lecture	2.3	0.0	0.0	0.0	0.0

Table 12

SUMMARY OF CHI SQUARE ANALYSES; ALL RESPONSES BY SUBSCALE BY SEX

Subscale	N	df	x^2	P
Projects	110	2	5.053	.079
Simulations	110	2	1.513	.469
Drill and Recitations	110	2	0.053	.973
Peer Teaching	110	2	5.085	.079
Discussion	110	2	1.897	.387
Teaching Games	110	2	14.62	.001
Independent Study	110	2	1.405	.495
Programmed Instruction	110	2	7.469	.024
Lecture	110	2	6.405	.041

ences ($<.05$ probability) were noted in the by sex comparison. As can be seen, responses of females were significantly higher in the subscales Teaching Games ($P<.001$), Programmed Instruction ($P<.024$) and Lecture ($P<.041$).

GPA

Table 13 was used to report the Chi-square analyses for the independent variable GPA. As can be noted, $<.05$ probability levels were manifested in the subscale responses for Discussion ($P=.020$), Programmed Instruction ($P=.054$) and Lecture ($P=.026$). The pattern of these responses was more complex than in the by sex analyses above.

In the case of Discussion responses, larger numbers of middle GPA respondents (GPA = 2.50 - 2.99 and GPA = 3.00 - 3.49) indicated "High Preference", while the highest and lowest GPA categories fell into the "Neutral" group.

The differences in the Programmed Instruction subscale were generally attributable to "Neutral" or "Low Preference" responses of the two (2) lower GPA groups (GPA = 2.99 and below).

Lecture response differences ($P = .026$) were a result of a positive view of the process by all GPA categories with the difference being manifested by a paucity of "Low Preference" responses and variations in "Neutral" area.

Table 13

SUMMARY OF CHI-SQUARE ANALYSES; ALL RESPONSES BY SUBSCALE BY GPA

Subscale	N	df	X^2	p
Projects	110	6	11.172	.083
Simulations	110	6	5.063	.536
Drill and Recitations	110	6	6.549	.365
Peer Teaching	110	6	8.543	.201
Discussion	110	6	14.983	.020
Teaching Games	110	6	7.705	.261
Independent Study	110	6	10.739	.097
Programmed Instruction	110	6	12.351	.054
Lecture	110	6	14.386	.026

Discussion

The majority of students showed high preferences for Peer Teaching, Discussion, Teaching Games, Programmed Instruction and Lecture. It is interesting to note that of these methods Lecture was preferred by the most students (72.7%).

While the reasons for these preferences occurring demand further exploration, the educational implications are certainly worth thinking about. Based on this group of students it would seem valuable to use a variety of teaching techniques that would involve these methodologies. A lecture approach that is facilitated by discussion and study groups would seem a viable approach. The use of micro-computers to provide for a programmed approach (as well as activities in a group situation) to help foster learning, would also seem appropriate for this group.

While one would suspect that college age students would prefer to learn through such activities as simulations and independent study, the opposite seemed true with this group. Is it possible that students are not taught appropriate independent study skills and thus shy away from this type of work?

The implications for the skills these students will need in the future relative to individual problem solving may be one aspect of concern relative to this phenomenon.

While both sexes maintained somewhat consistantly high preference subscales, females did tend to prefer Teaching Games and Programmed Instruction over males. This was validated in the Chi-square analyses (Table 12). This could support the collection of research that indicates that females prefer to engage in more independent, individual learning activities while males are more dependent upon authority figures for their information.

The GPA results present some interesting information that one could investigate further. Independent Study was not highly preferred by any of the groups. While one would expect higher GPA students to prefer this method of learning, only 22.2% did. Could this be indicative of the lack of independent study experience at the college level? Or, perhaps the poor construction of independent study activities which turn off the more capable students and frustrate the less capable ones has impact here.

The last pattern reported relating to Discussion has some interesting implications. These results could perhaps support the contention that the C-average student is more extrinsically motivated; requiring the support and enthusiasm of others around him/her to generate the emotional desire to learn. While the brighter (A average) students are more intrinsically motivated; not needing much peer energy to tap the emotional motivation to learn.

Simulation activities ususally involve more abstract, holistic problem solving abilities. The data indicating that 38% of the 3.5 - 4.0 GPA students did not prefer this mode may be indicative of the more linear, sequential, convergent processing modes that these students seem to possess.

Of particular interest was the large number of students from large schools (90%) preferring Discussion as compared to the relatively small number of students from small schools (43%) preferring this method. One possible suggestion for this phenomenon could center around the lack of discussion occurring in large schools which would perhaps link students to this choice because they have not experienced it. Or, could it be that large schools employ teachers with higher level skills in discussion methods and thus these students have had a more rewarding experience with this technique?

The data in Table 13 may support an earlier contention that B and C average students are more socially orientated, i.e., they prefer to experience learning from an extrinsic, group process rather than an intrinsic, individual process.

Recommendations for Future Study

There seem to be several questions unanswered as well as many new questions established relative to the results of this study. Research into the following questions

should prove beneficial to the college/university professor.

Initially it must be pointed out that the scoring process as outlined by the instrument authors were designed to expedite hand scoring and interpretation by practicing classroom teachers. An example of this is the practice of averaging the individual item score within each subscale, and then further collapsing this score into high and low preference areas. This process eliminates a good deal of variance. The data analyses also forces the researcher to resort to ordinal level statistical analyses such as Chi-square. The present authors would recommend that future research with this instrument be conducted with raw data that has not been subjected to these adjustments.

It would be interesting to explore, in more depth, the relationship of internal locus of control to female preference for independent study. In this same light, the concept of external locus of control to the lack of preference for independent study on the part of males would also be interesting to explain.

The concept of intrinsic vs. extrinsic motivational styles and social interaction as a force in choosing or not choosing Discussion as a mode of learning could yield some very important and interesting data if further researched.

Further exploration into the processing modes of bright vs. average students may also provide some enlightening concepts.

Lastly, should there be a relation between the size of a student's class and their learning preference, it may prove valuable to discover why this relationship exists and what is causing it.

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